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JOINT COUNCIL ON FOOD AND AGRICULTURAL SCIENCES

1978 ANNUAL REPORT

To the Secretary of Agriculture

Joint Council on
Food and
Agricultural
Sciences

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Washington, D.C.

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March 1979



DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20250

Honorable Bob Bergland
Secretary of Agriculture
Washington, D.C. 20250

Dear Mr. Secretary:

We are pleased to submit the first annual report of the Joint Council on Food and Agricultural Sciences.

The Joint Council was established by P.L. 95-113. Its membership includes representatives from institutions having research, extension, and teaching responsibilities in the food and agricultural sciences, from the Office of Science and Technology Policy, and from the public. The institutions represented include public and private universities and colleges, private organizations, and USDA agencies.

Since the first meeting in April 1978, the Joint Council has necessarily spent a considerable amount of time on developing an organizational structure and procedures to fulfill effectively the responsibilities mandated by Congress. One of these responsibilities is to encompass in our planning and coordination efforts the full range of public and private institutions engaged in food and agricultural research, extension, and teaching. Another is to build on existing regional and national structures and mechanisms for coordination and cooperation. These two functions have demanded substantial study, broad participation by the affected parties, and extensive deliberation by the Joint Council. At its January 1979 meeting, the Council is slated to decide on its long-term organization.

In its first year, the Joint Council was also able to give some attention to program needs in areas of high priority. Recommendations on these are included in this report. During the next and ensuing years, the Council will devote much more of its time to this important function and to specific activities for fostering coordination.

We appreciate the opportunity to provide you with this information on the achievements and status of the food and agricultural sciences and our recommendations regarding them.

Sincerely,

JOHN S. ROBINS
Cochairman
Joint Council on Food and
Agricultural Sciences

M. RUPERT CUTLER
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EXECUTIVE SUMMARY

AND RECOMMENDATIONS FOR NEXT YEAR

This first annual report of the Joint Council on Food and Agricultural Sciences is presented in four parts: (1) achievements reported in the past year, (2) status of ongoing research and extension projects, (3) current activities in planning and coordination, and (4) recommendations for the next year.

ACHIEVEMENTS

The contributions of the technical and social sciences to food, agriculture, and forestry have been a major factor in the record high levels of farm and forest output in recent years. The supply of food and fiber for consumers has been adequate, and the export trade of farm products has been maintained at a high level. The tremendous capacity of our Nation to produce agricultural and forestry products is one of the primary weapons against inflation and is highly supportive of the value of our currency abroad.

This report contains only selected examples of the countless achievements in research, extension, and teaching at local, State, regional, and national levels.

Research

The eradication of hog cholera in the United States in 1978 typifies the way research, extension, and teaching provide scientific information for farmers and regulatory agencies to attain national goals. The research started nearly a century ago. Two major breakthroughs in vaccination and diagnosis enabled the eradication program to start in 1961. The victory over this disease in 1978 was the result of a massive Federal-State-farmer-industry cooperative effort.

Other examples of achievements in research on food and fiber productivity include development of a new variety of soybean resistant to lodging and a virus-resistant tomato, techniques to increase rubber yields from guayule, increased processing yields for sweet corn, and economic assessments of pesticide regulations.

Research on human health and welfare showed that bread containing a high cereal fiber content reduces serum cholesterol in humans and that baby formulas can be improved by being fortified with iron when the babies are 4 to 12 months of age.

Research on environmental quality and natural resources resulted in a variety of cotton highly resistant to bollworm, tobacco budworm, and corn earworm. A bacterium and a virus have been registered as biological control agents for Douglas-fir tussock moth. Methane production from livestock has proved to be technologically feasible, and significant advances have been made

in the use of solar energy and wind power. A lightweight truss-frame house developed by forestry products research saves both labor and lumber costs.

Extension

Extension demonstration farms with beef producers in Ohio showed practices that yielded 100 percent calf crops and average weaning weights of 600 pounds. Educational programs for wheat producers were expanded and included a pilot project on how to deal with risk and uncertainty. Extension had an active role in the USDA national sulfonamide residue action plan to help swine producers reduce residue violations.

In Extension's human health and welfare achievements, the Expanded Food and Nutrition Education Program (EFNEP) reached 386,000 low-income families, of which 60 percent were in minority groups. Improvement in food consumption practices of EFNEP participants was 60 percent higher than in previous evaluations. Extension-sponsored homemakers in Florida obtained a clinic for their county. In Michigan a statewide health screening program resulted in 2,000 participants in blood pressure clinics, 900 glaucoma checkups, and 1,700 in drug use and abuse programs.

Extension programs in energy management and conservation have resulted in the use of nearly 154 million fewer gallons of gasoline and 60 fewer gallons of diesel fuel in field operations--a savings of about \$95 million per year.

Higher Education

During 1978, higher education in food and agricultural sciences increased curricula offerings in international agriculture, consumer economics, communication, and food and nutrition. Interdisciplinary curricula continue to expand. Increasing numbers of women are enrolled in agricultural science.

Disseminating Information

New sources of consumer information in 1978 included a consumer periodical, farmer newsletters, a report on pesticide supply and demand, and a handbook for forest managers.

In 1978, the Agricultural Sciences Information Network was able to deliver 90 percent of the documents requested by researchers. In 1977, the record was only 50 percent.

The USDA's Food and Nutrition Education Resources Center reached an additional audience of 5,200 persons through 20 new promotion programs.

STATUS OF ONGOING RESEARCH AND EXTENSION PROJECTS

Research

Of the nearly 12,000 scientist years in research effort during FY 1977, 65 percent was devoted to research on food and fiber productivity. More than

half of this was performed at State and other cooperating institutions. The number of scientist years devoted to this research area increased only slightly since 1970. Combined State and Federal fund increases have been only slightly more than enough to meet rising inflation costs.

Scientist effort on human health and welfare problems was 10 percent of the total--only a slight increase since FY 1970. But both State and Federal funds for this research increased markedly.

Research on environmental quality and natural resources reflect considerable increases in scientist years and funds since 1970.

Extension

Extension programs were carried out by 3,150 county governments in all the States and territories. State and county financial support was 58 percent of the total; 42 percent came from USDA.

Extension effort on food and fiber productivity was 38 percent of the total; human health and welfare, 58.5 percent; and environmental quality and natural resources, 3.8 percent.

Redirections

Redirection of research and extension activity is a continuous process at all levels. In research, there was an increase between 1970-77 by as much as 166 percent in food and nutrition. In extension, there were increases of 84 and 98 percent in activities in natural resources and environment, and of more than 200 percent in the economic growth aspects of rural community development. These increases in both research and extension were necessarily paralleled by decreased effort in lower-priority activities.

CURRENT ACTIVITIES IN PLANNING AND COORDINATION

In 1978, planning and coordination took on a new dimension when the Secretary of Agriculture established the Joint Council on Food and Agricultural Sciences in accordance with P.L. 95-113. The primary responsibility of the Council is to foster coordination of research, extension, and teaching activities.

The Council met three times in 1978. It has continued national and regional research planning activities. It is developing a revised planning and coordination structure that will encompass teaching, extension, and technical information as well as research.

RECOMMENDATIONS FOR THE NEXT YEAR

The Joint Council strongly endorses support of Hatch, Smith-Lever, McIntire-Stennis, 1890 Research (P.L. 95-113), Bankhead-Jones programs, and in-house funding for the continuation of strong research, extension, higher education, and technical information functions. These base programs need continued vigorous support without suffering loss of status or effectiveness

from special or competitive grant programs. They form the core programs upon which basic new thrusts can be built through special grant programs.

The Council also supports the continued initiative of the USDA and the Congress in providing competitive grants in plant biology and human nutrition. The Council also supports broadening the base of competitive grants to other areas such as animal biology. In addition, the Council applauds the new initiatives in support of human nutrition, tropical research, and animal health.

The Joint Council recommends a continuation of ongoing efforts for planning and coordination as cited earlier in this report. New structures and processes are being developed to formalize and integrate planning and coordination of teaching, extension, technical information, and research. In developing these procedures, the Council will be guided by the principles of cooperative effort and mutual agreement, thus adhering to Congressional recommendation to build on the strengths of existing national and regional efforts.

The Joint Council recognizes specific subject areas that would benefit by more effective coordination among research, extension, teaching, and technical information. Examples of such areas are: Food and agricultural policies, rural development (with special emphasis on small farms), integrated pest management, animal health, energy, marketing and transportation, human nutrition, land and water use, multiple use of forest and rangelands, data base systems, basic research in agricultural production, and weather, climate, and plant stress. The Council has selected four of these areas for special consideration and coordination efforts during the next year: human nutrition; integrated pest management; weather, climate, and plant stress; and small farms.

Human Nutrition

The importance of research, extension, teaching, and technical information in human nutrition has been firmly established by a score of reports and activities since the 1969 White House Conference on Food and Nutrition and Health. Congress responded to these reports in the Food and Agriculture Act of 1977 by stating that new Federal initiatives are needed in research and extension on human nutrition and food consumption patterns in order to improve the health and vitality of the people of the United States.

Ongoing Programs

Ongoing programs includes (a) conducting research on requirements for nutrients, (b) identifying the forms of those food nutrients that may be useful in meeting human requirements, (c) collecting accurate, up-to-date information on the composition of all important foods that supply those nutrients, and (d) developing an understanding of the factors influencing consumer choice.

The Federal-State research and extension systems provide information on consumer attitudes toward food choices, diet, and human health. Estimates are being made of the effects of changes in American dietary practices on the

agricultural sector. Research identifies techniques for people to select adequate diets within their budget limitations.

Extension and teaching programs in nutrition are directed toward groups considered vulnerable to nutritional risks, such as the elderly, pregnant women, infants, and young children. Major programs also include weight control, food preservation and safety, and food shopping. The USDA Food and Nutrition Information and Education Resources Center is providing assistance on nutrition education and food service management. In addition to aiding school food service personnel, the Center services researchers, nutritionists, extension personnel, educators, and others.

Current Program Needs

Human nutrition programs must be able to respond quickly and accurately to requests for food policy analysis. One high priority is research on human nutrient requirements and on nutritional status monitoring. Another relates to public concerns over food quality and safety.

Another significant current need is the development of sound dietary guidelines and supporting educational material for consumer use. A strong competitive grants program can provide the basic research knowledge needed for the guidelines and materials.

Federal-State programs need more scientists and applied nutritionists to carry out ongoing and proposed activities.

Development of a network of mission-oriented human nutrition laboratories will provide a national scope to the Human Nutrition Center program. In addition, the network of university nutrition centers and regional human nutrition laboratories needs to be strengthened by a more direct linkage system.

Development of a national nutritional information system has high priority.

Integrated Pest Management

Public concern is rising about the potential hazards of long-term exposure of people to pesticide residues on food crops and the harmful impacts on endangered and beneficial species. Yet pest problems are increasing in the United States and something must be done to alleviate at least some of the \$10 billion annual crop losses due to diseases, nematodes, weeds and insects.

Integrated pest management is now recognized as a high priority program that can lessen these concerns. It is a program that emphasizes the use of a combination of cultural and natural biological controls such as predators, pest-specific diseases, pest-resistant plant varieties, and hormones; in effect it is a production management system, relying on chemical agents only as needed.

Several agencies are developing recommendations to meet the national needs in this area. Public benefits from integrated pest management would be (a) maintenance or improvement of environmental quality through more judicious use of pesticides, (b) reduction of agricultural energy requirements, (c) stabilization of production costs and productivity, and (d) evaluation of these efforts. In addition, current pest losses can likely be reduced by 10 percent--or a benefit of \$1.3 billion annually.

Ongoing Programs

Among the ongoing integrated pest management programs are (a) crop rotation for managing nematodes, insects, diseases, and weeds; (b) use of trap crops; (c) integrating pest and cultural management systems; and (d) basic research on attractants, biological agents, and germ plasm. In Mississippi, for example, less than 400 acres had to be sprayed for boll weevils by late July 1978, whereas several years ago, all fields would have reached damaging economic thresholds for boll weevils early in July and would have required extensive spraying. Boll weevil trap catches in 1978 were 50 percent less in August and September 1978 than in the same months in 1977.

Current Program Needs

The acute research needs for developing integrated pest management programs are (a) devising new or improved systems using selected pests and having two or more control components available for integration, (b) developing new or improved pest control components required to improved or complete a system, and (c) selecting crops that have prospects for integrated management of two or more pest groups. A strong emphasis should also be placed on integrated pest management programs for livestock, pastures, and stored products pests and their economic feasibility.

Integrated pest management extension programs are, to some degree, currently underway in every State. The ability to expand these programs depends on development of new technology, on grower acceptance, and on funding. There is also an acute need to improve the research and extension bases at the State level through Hatch and Smith-Lever programs and in regional research programs.

Integrated pest management will not become an effective program without thorough planning and coordination at State, regional, and national levels.

Weather, Climate, and Plant Stress

Crop production depends directly on several environmental factors including (a) soil and the nutrients it supplies; (b) air, which supplies carbon dioxide for photosynthesis; (c) sunlight, which provides the energy to drive the whole system; and (d) adequate moisture. Weather and climate research deals with all these factors.

Adverse weather accounts for annual crop losses of about \$8 billion in the United States. These losses could be reduced considerably if agriculturists better understood the influence of adverse weather on crop yields at

different stages of plant development. This knowledge can come only from research,

Other production losses are caused by air pollution which leads to plant stress, but unfortunately the United States has insufficient data about the accumulation of airborne contaminants and their effects on plants.

Ongoing Programs

Within the past several years, Federal-State research has emphasized development of mathematical models to describe plant response to changing environmental conditions. New remote sensing hardware has been used to monitor plant stresses and aid in field validation of these models. Several regional research projects are being conducted cooperatively by university and Federal scientists.

A new extension program authorized in October 1978--the "Green Thumb" agricultural weather dissemination system--will be tested during the next 3 years in two Kentucky counties. Joint efforts of the Kentucky Cooperative Extension Service, the National Weather Service, and SEA Extension will provide up-to-the-minute information on weather, agriculture, and markets to farmers. The devices used will be part of the television and telephone receivers in the farmers' homes.

Another cooperative project relies on rural volunteer weather observers who enter their observations directly into a central computer. The data are used by weather forecasters and extension personnel for predicting models.

Current Program Needs

Research is hindered by inadequate facilities to put validation data in forms that might be used as data sets for other modelers and thus have practical application. Staff limitations prohibit the wide use of these data for assessing plant responses. Research is also limited in the use of crop production models because of inadequate weather data bases. Better planning and coordination among the Departments of Agriculture and Commerce and the State institutions is essential if the necessary data are to be provided.

Small Farms

Of the 2.75 million farms in the United States, about 2 million of them have gross sales of under \$20,000 and are classified as "small" farms. Owners and operators of these small farms are particularly affected by some long-continuing trends in agriculture: rapid decline of the number of farms, increasing average size of farms, substitution of capital for labor, and increasing capital requirements. For the small farmer, these problems are further aggravated by instability of prices, inflation, and high levels of risk and uncertainty. Thus, a long-cherished idea that a family should be able to own and manage a farm and derive an adequate income from it is threatened.

Although small farmers control 31 percent of all farm assets, they produce only 10 percent of our agricultural products and 21 percent have incomes below the poverty level. About 83 percent of their income comes from nonfarm sources, but this figure is misleading because many small farmers have no off-farm income at all. Without help, they can do little about their situation. The issue is not one of agricultural product; it is one of human well-being. A preferred approach is to help set the conditions under which these families can increase their income from all sources through their own efforts, and achieve their aspirations for a higher level of living.

Ongoing Programs

Several interrelated activities of the research, extension, and teaching components of the Science and Education Administration relate to small farms. These include (a) helping to identify family goals, needs, resources, and opportunities; (b) helping families find and assess alternative ways of responding to needs and opportunities both on and off the farm; (c) developing the skills and technology needed by farm operators and their families to carry out preferred alternatives, increase income, and improve their quality of living; and (d) providing direct educational and technical assistance to operators and their families.

Recognition of the changing structure of agriculture has directed more attention to the research agenda, the impact of research on small farms, and the specific needs of small farms. As a result, a number of research projects specifically oriented to small farms have been initiated. The Current Research Information System (CRIS) showed 67 such projects in late 1978. Development of research programs at the 1890 Land-Grant Universities has facilitated this effort because nearly half of the research projects were in the 1890 institutions.

Research already completed or currently underway has emphasized assessment of needs and characteristics of small farms, needed adjustments in farm operations, marketing alternatives, finance, appropriate technology, and off-farm employment opportunities.

Extension programs have obvious relevance to the educational needs of families on small farms. Although extension programs have been available to small farmers, they have not usually participated.

More than 20 States now have paraprofessional programs for small farms. The paraprofessionals, or educational assistants, are hired to work closely with small, part-time and limited resource families. Such programs in Texas and Missouri already show improved production practices and better incomes of participating families. In addition to the paraprofessional programs, a number of States have diverted professional agents to work primarily with small farmers.

Current Program Needs

Research and education efforts currently underway primarily represent redirection of program efforts in selected States. If the needs of the

larger number of families living on small farms are to be dealt with on a national basis, additional funding will be required. A significant proportion of small farm families can be reached only if additional paraprofessionals or other forms of direct assistance are provided. Similarly, additional research efforts are needed to provide the information base for extension activities.

Knowledge gaps are obvious. Research is needed to adapt existing technology for small farms and to investigate the feasibility of new technology more appropriate to small farms. Markets for the produce from small farms are lacking. Research is needed to explore market alternatives; evaluate the effects of government regulations, and other public policies; and investigate strategies which would help small farmers deal with market instability.

Because of the importance of off-farm income to many small farm families, additional research is needed to help develop off-farm income opportunities. The small farm family must be looked at as a firm which has labor and other resources that can be used on the farm or in off-farm activities. This emphasizes the complementary nature of research on rural development and small farms.

Research and education programs need to be expanded and integrated with other USDA programs targeted to small farms.

ACHIEVEMENTS

A survey of the history of U.S. food and agricultural science achievements shows that the system has produced to a phenomenal degree.

The achievements have been spectacular, particularly in the area of food and fiber productivity. Farm output in recent years has been at record high levels. These gains have helped assure an adequate supply of high-quality food at reasonable prices for domestic use. Net agricultural exports of \$10.6 billion have helped offset the trade deficit in the nonfarm sector and have eased the burden of the energy crunch.

This Joint Council report surveys some of the most recent accomplishments in research, extension, higher education, and information dissemination. The report also sets challenges and priorities for the future and emphasizes the need for cooperation and coordination among all those who are a part of the system.

To make the report meaningful to a wider audience, we classify and discuss the achievements in research and extension by the following program areas: food and fiber productivity, human health and welfare, and environmental quality and natural resources.

RESEARCH ACHIEVEMENTS

The following achievements represent selected examples among hundreds that might have been cited.

FOOD AND FIBER PRODUCTIVITY

Research achievements in the first half of the 20th century are better known in the area of food and fiber productivity than in any other area. Gains are still being made, of course, but there is reason to believe that much of the "easy" research is behind us. Nevertheless, a number of achievements in the past year clearly demonstrate that plateaus of performance are being pushed higher.

Hog Cholera Eradication

After nearly a century of research and two decades of a Federal-State eradication program, hog cholera--the most costly and deadly swine disease the United States ever had--has been completely eradicated from American farms. Researchers first experimented with a "live" vaccine, but then discovered that a "killed" vaccine offered the possibility of stamping out the disease. The final breakthrough occurred when a test was developed to detect the disease in "carrier" hogs that did not show symptoms.

The eradication program, which was completed in 1978, cost \$140 million. The savings are much greater. As recently as the early 1960's hog cholera was still costing producers \$50 million a year.

While farmers benefit most directly from eradication of this livestock disease, consumers benefit too because pork prices would be higher if farmers were still paying the costs of disease control. Foreign markets are also now open to pork shipments, helping out in our balance of payments. In 1978, England alone imported \$10 million worth of U.S. pork.

New Semi-Dwarf Soybeans

In the early 1920's, soybean yields in the United States averaged only about 11 bushels per acre; today the nationwide average is about 28 bushels per acre. Cultural practices helped, and soybean breeding played a large role. However, one of the weaknesses of improved varieties was early lodging (falling over) which made harvesting difficult or impossible in some cases.

Now, a new semi-dwarf soybean variety, named Elf, is more resistant to lodging and thus can produce higher yields in soils where taller varieties are more susceptible to lodging. The Illinois and Ohio agricultural experiment stations conducted the research in cooperation with the USDA. Seed is expected to be available for general farm production in 1979.

"Curly Top" Breakthrough

After 60 years of searching, a permanent, inexpensive, and nonpolluting solution to the "curly top" virus in tomatoes seems assured. Scientists succeeded in transferring complete "curly top" virus resistance from wild tomatoes to hybrids of wild and cultivated tomatoes. This should eliminate large annual losses and open up additional areas to tomato production.

Discovery of Enteric Viruses in Cattle and Swine

Using germ-free animals in the laboratory, research scientists have identified new viral agents that cause major losses from enteric (intestinal) diseases in cattle and swine. Enteric diseases cause a high proportion of all mortality and morbidity in young calves and pigs. Annual losses in swine are estimated to cost the industry \$150 million and calf losses equal nearly 10 percent of all calves born. Basic information on these enteric viruses will permit the development of vaccines and preventative practices which will be of great economic importance to the livestock industry.

Unit Kernel Sweet Corn

A new method has been devised for removing kernels from the cobs of sweet corn without cutting. A second season of testing confirmed that unit (intact) kernel sweet corn is consistently preferred by taste panels over conventionally cut products. The new method increased processing yield 15 percent for all varieties tested. Two equipment manufacturers have started developing equipment for kernel removal. This procedure has promise for eventual application to field machinery for separation of kernels--thus reducing raw product costs and trash hauling costs.

More Rubber from Guayule

A chemical method of dramatically increasing yields of rubber from the lowly desert shrub, guayule, has raised new possibilities of producing natural rubber commercially in the United States. During World War II, the potential of guayule was recognized and some rubber was produced, but after the war the United States turned once again to the Hevea tree in Malaysia and to synthetic rubber.

USDA research in California has shown that if the guayule plant is sprayed with compounds called bioregulators--mixtures of low-cost chemicals--about 3 weeks before harvest, it produces two to six times its normal yield. The implications of a cost-effective guayule plant are enormous.

Extended Shelf Life for Fresh Poultry

The nation's poultry packers are preparing to adopt a new packaging technique for fresh chicken perfected by a Minnesota food scientist. Freshly slaughtered birds are placed in air-tight bags filled with carbon dioxide. As the poultry absorbs the carbon dioxide, the bag tightens around the bird. Packers can use cheaper transportation and bacterial growth is lower on birds packaged in a carbon dioxide atmosphere; shelf life of poultry protected by carbon dioxide can extend to 27 days or more at 34° F. as compared with 10 days when birds are packed in ice; and economies can be made in packing and shipping.

Expansion of U.S. Agricultural Exports

Recent research accomplishments are contributing significantly to the expected \$100 million increase in 1979 in fruit and vegetable exports. New fumigation and insect control treatments for iceberg lettuce, sweet cherries, and citrus opened up markets in Japan for U.S. producers last year. An instrument for determining hidden insect damage in grains has also been patented and licensed for manufacture. Over 900 commercial refrigerated container vans are now in transatlantic service, carrying about 15 percent more perishable cargo and delivering better quality products overseas.

Assessments of Pesticide Regulations

Economic assessments have been made of the uses and regulations of a number of agricultural pesticides. One of these products--trifluralin--is used extensively for controlling weeds in cotton and soybeans. The Environmental Protection Agency (EPA) was petitioned in February 1977 to immediately suspend use of this herbicide. EPA denied this petition. Its decision was based on an economic assessment by USDA which showed that farmers would lose \$520 million in the first year and about \$133 million per year in the long run.

Economic assessments of the other products will be weighed and evaluated on a risk/cost basis when appropriate.

HUMAN HEALTH AND WELFARE

Increased priority is being given to issues of human well-being and quality of life. Significant advances are being made in research and education on the protection of consumer health and in human nutrition. More attention is being given to the nutritional requirements of specific age groups: children, adults, and the elderly. The total population will benefit from this research. For example:

Reducing Serum Cholesterol Levels

Nutrition scientists at USDA's Human Nutrition Laboratory in North Dakota, aided by researchers at the USDA Northern Regional Research Center, Peoria, Illinois, have determined that bread made by adding hard red spring wheat bran, finely ground soybean hulls, or corn bran to white flour was associated with a lowered serum cholesterol level when eaten by healthy men over a period of 4 to 8 months. Those consuming the high fiber bread had a 14-percent decline in cholesterol levels as compared with those on control diets.

Dietary Fiber and Glucose Tolerance

Dietary fiber--including corn bran, soy hulls, apple powder, and carrot powder--has been shown to improve glucose tolerance of normal men when 26 grams of the fiber was added daily to the normal diet. These effects were associated with an apparent increase in the effectiveness of insulin and a decrease in the glandular secretion of glucagon (a hormone that opposes the action of insulin). The effects were also associated with a decrease in total serum cholesterol and LDL (low-density lipoprotein) cholesterol in most of the test individuals.

Role of Dietary Fat on Reduction of Blood Pressure in Man

It was demonstrated that many factors must be considered in the overall assessment of the efficacy of dietary fat modification. Fat modified diets can lead to a reduction in both systolic and diastolic blood pressure in men and others with borderline hypertension. While either a reduction in the total calories from fat or an increase in the relative consumption of polyunsaturated vs. saturated fat was beneficial, maximum effects on both systolic and diastolic blood pressures were observed when, simultaneously, the calories from fat were reduced and the consumption of polyunsaturated fat was increased. Changing the level of fat in the diet compared to changing the relative amounts of saturated vs. unsaturated fat produced markedly different effects on blood lipids.

Influenza Epidemics

Scientists at the USDA's Plum Island Animal Disease Center, New York, have developed strong clues as to the origin of widespread epidemics such as Hong Kong and Asian flu. Cooperative research at the Plum Island Center and St. Jude's Children's Research Hospital in Memphis, Tennessee, indicates that new forms of flu arise from recombinations of different viruses--either from

man or animals or both. Since there are no antibodies in the blood to protect persons from these new viruses and no vaccines against them, epidemics become widespread. If further research proves their theory valid, researchers plan to collect specimens of each form of influenza identified in nature. Then when a new virus appears, it could be compared with those in the virus bank, its origin pinpointed, and scientists would have a reference for making new vaccine to head off an epidemic.

Baby Formulas

Babies do not benefit from iron-fortified formulas during their first 4 months of life. However, scientists found that babies are less likely to develop iron deficiencies if they are put on such formulas during the last 8 months of their first year. The finding could help prevent iron deficiency in the 80 percent of infants in the United States fed formulas exclusively during their first year of life.

A study of 92 female infants showed that babies switched from formula or breast feeding to skim milk often develop a calorie deficiency. It suggested that a low-calorie diet for infants may be too high a price to pay for the possible prevention of obesity and arteriosclerosis.

Heart Valve Transplants

Each year about 20,000 people in the United States undergo heart valve transplants. Valves from pig hearts make excellent replacements for human heart valves because they are durable, resistant to infection, and not readily rejected by the human body. Valves are taken from pigs weighing about 80 pounds, and since pigs in this country are slaughtered at around 200 pounds, the United States must import its supply from certain foreign countries where pigs are slaughtered at 80 pounds or less.

However, these imported hearts had the potential for carrying undesirable livestock diseases to our country. But USDA scientists at the Plum Island Animal Disease Center developed a way to inactivate any disease viruses and still not damage the heart valves.

ENVIRONMENTAL QUALITY AND NATURAL RESOURCES

Increasing demands are placed on limited resources for uses that often result in a deterioration of environmental quality. Environmental quality and natural resources research is given high priority in the Federal-State agricultural and forestry research programs of the Department and the cooperating universities. Greater emphasis is being given to pollution reduction, energy production and conservation, and more effective management and utilization of forests, soil, water, and other natural resources.

Reduced Pesticide Usage

A couple of decades ago the solution to new pest problems used to be to apply pesticides--whether the pests were insects, diseases, or weeds. The usual procedure was to "seek and destroy," in contrast to today's integrated pest management approach.

The intensive program to develop insect-resistant cotton is a good example of what agricultural research is doing to keep potentially harmful materials from entering an already polluted environment.

In Arizona and Oklahoma, in two cooperative Federal-State projects, scientists have developed a cotton variety without nectaries (organs that secrete a high-sugar liquid which attracts the pink bollworm moth). Tests already show that nectariless cotton plants sustained 44 percent less damage from the pink bollworm than varieties without this resistance. The nectariless cottons also show resistance to the tobacco budworm and corn earworm, both pests of cotton.

Plant scientists at Oklahoma are working with additional cotton strains that have insect-resisting factors such as a high gossypol content or are hairless (glabrous) plants. Such strains were resistant to bollworms and flea hoppers under Oklahoma conditions, with only slightly reduced yields.

Energy Research

Methane production is currently under study in the field of livestock waste management. In Texas alone, the 10.6 million tons of livestock and poultry manure produced annually could be converted to about 14 trillion BTU's of energy per year as methane. Much research needs to be done, however, before the process is economically feasible. A Texas pilot plant now produces 175 cubic feet of biogas per day from manure from four cows. Private industry is showing interest in the project and plans are set to build larger plants. Similar projects are being conducted in other States.

Studies on the feasibility of converting agricultural wastes and byproducts to energy indicate that there are difficult technical, economic, and structural barriers to be overcome before bioconversion can be widely adopted in U.S. agriculture. About 760 million acres of land in farms is used for crops, pasture, range, and forest. Most of this land produces residues or has potential for biomass production to generate energy. However, the feasibility of doing this is still questionable. Costs are high, additional conservation measures would be necessary to prevent degradation of the land, and if land is taken out of food, feed, and fiber production, the cost of these products would rise or alternative sources would have to be found.

Other kinds of energy research projects are being conducted at State agricultural experiment stations. Conversion of windpower and solar heat are getting much serious attention. In Ohio, engineers reported use of 57 percent less steam in night-time heating of greenhouses by covering the glass with a double layer of air-inflated plastic covers.

Utah has a windpower project that shows great potential for the upper elevations of that State. The Louisiana Experiment Station is building a full-scale solar-heated lumber drying kiln. Initial tests with pilot projects have been encouraging. Ohio has completed a project which shows that 8 of the 39 coal-burning steam-electric plants in Ohio may have the necessary

capacity to make the combustion of corn stover to be economically feasible. Corn stover dry matter ranges between 6,500 and 8,000 BTU's per pound compared to 12,000 BTU's per pound of coal.

Lightweight Truss-Framed House

The lightweight truss-framed house, a product of engineering research, became a reality through the mutual efforts of the USDA Forest Service and the University of Wisconsin. This new system uses a trussed floor and roof with conventional wall studs for a unitized frame. It is designed to use less lumber per square foot of house and to lower construction costs. A prototype 40- by 26-foot house was erected by a three-man crew and a light crane in only 6 hours. The truss-framed house cost an estimated \$2,300 less than a conventional counterpart. Such savings can be expected to increase as the system becomes more widely used. Existing truss plants and wood manufacturing firms have facilities, equipment, and skills to mass produce truss frames throughout the United States.

Control of Douglas-Fir Tussock Moth

Before the 1970's, DDT was the standard control method for the Douglas-fir tussock moth. The Environmental Protection Agency banned its use for forest insect control in 1972. Anticipating such action, the USDA and several universities had already started a research program to develop microbial control agents. Two such agents were registered in 1978, the result of highly complex research and a long registration process. One, a bacterium, was the first insecticide to be registered for tussock moth control since DDT. The other, a natural virus, was the first virus to be registered for control of a forest insect. These new materials used alone or in combination with selective chemical insecticides offer less environmental hazard in treatment of tussock moth outbreaks.

Wood and Paper Processing

North Carolina experiment station researchers have developed a new pulping process that reduces water and air pollution and energy consumption, and at the same time produces good quality pulp. The process consists of pulping with soda to remove enough lignin (a major component of wood) so that wood fibers can be easily separated. Oxygen is then injected into the pulp to remove the rest of the lignin. This produces quality pulp without causing environmental problems.

EXTENSION ACHIEVEMENTS

The Food and Agriculture Act of 1977 enabled the Extension Service to broaden its role and expand its service to people. Furthermore, as a result of the restructuring within USDA, including the creation of the Science and Education Administration, Extension opportunities for continuing cooperation and coordination with research and teaching have been strengthened. The challenge Extension faces is to expand its capacity to serve a large, diverse clientele on a broad spectrum of concerns.

The following achievements illustrate the diversity of Extension's educational programs, which are jointly determined and funded through Federal, State, and local governments.

FOOD AND FIBER PRODUCTIVITY

Commodity-Industry Programs

Extension has set up a number of commodity-industry programs with producers of wheat, soybean, cotton, swine, beef, sheep, and other commodities. Through these programs, industry leaders, extension specialists, and researchers from national and State levels identify problems, determine educational priorities, and develop educational materials that can be used throughout the country.

Extension programs have helped beef producers improve their efficiency through better production technology, crossbreeding, and performance testing. In Ohio, demonstration farms were set up to show beef producers how to improve their breeding stock by establishing better pastures. Nearly half of these demonstration farms produced 100-percent calf crops in 1976, and calves of five herds had average weaning weights of 600 pounds.

All State Extension Services are cooperating in the development of a National Pork Industry Handbook containing educational material based on the latest research information available. The handbook is rapidly becoming the standard for swine educational programs at all levels within the land-grant system.

Significant improvements in U.S. swine production include the following (1) increased sow productivity from 1.6 to 1.8 litters per year and an average of 0.75 more pigs per litter, (2) an improved feed efficiency of 0.4 pound of feed per pound of gain in market hogs, and (3) a reduction of 14 pounds of lard per 100 pounds of carcass.

Outlook Information

In today's market-oriented agriculture, farmers need current economic information to help them make decisions. Often, they need this information faster than mail can deliver it. Now, a Computerized Outlook Information Network (COIN) is providing 30 State Cooperative Extension Services and some counties with most of the USDA crop and livestock outlook reports. More and more county and area extension offices are getting terminals and accessing these reports. States get most of the reports the day they are released, instead of depending on mail service which often means a delay of 3 to 10 days.

Risk and Uncertainty

Educational programs for wheat producers have been expanded over the past year. One effort was aimed at assisting producers to incorporate risk

considerations into their marketing, management, and production decisions. A pilot project in risk and uncertainty was conducted by Oregon and Oklahoma State Universities. The project involved the development and testing of educational materials to help wheat producers deal with risk and uncertainty. A number of publications, slide tape presentations, and several computer programs were prepared. Other State Extension services are now using these risk and uncertainty materials in their educational programs.

Sulfa and Antibiotic Residue

Sulfonamides have been used increasingly since the early 1950's by the swine industry for the prevention and control of swine diseases. Most swine producers are convinced they could not economically produce hogs without these drugs.

Since 1973, USDA has been monitoring drug residues in swine. They have found that from 10 to 15 percent of slaughtered hogs exceed the legal tolerance set by the Food and Drug Administration. If this continues, sulfa drugs could be banned for other than therapeutic use in swine.

A USDA national sulfonamide residue action plan has been developed. It will aid the swine and feed industries when violative levels of residues are detected in swine at slaughter and it will significantly reduce the percentage of future violations.

Extension is playing a key educational role in this effort. If slaughter hogs with excessive sulfa residues are found, the producer is notified, usually through the Extension Service, and information is provided to help eliminate residues.

Extension has also been working closely with a USDA industry task force to develop an educational program aimed at helping dairy farmers eliminate antibiotic residues in slaughter dairy cattle. In January 1979, a new STOP (swab test on premises) program was initiated. Under the program, USDA inspectors are using a new screening test to detect illegal antibiotic residues in cull dairy cattle. Extension is using its educational channels to inform dairymen about the program.

HUMAN HEALTH AND WELFARE

Urban Gardening

Sixteen large metropolitan cities participated in Extension's 1978 urban gardening program. This program is aimed at fighting inflation and improving nutritional status by helping low-income families grow their own vegetables in the inner city.

Some 92,000 low-income adults and youth participated in the 1978 program, producing vegetables valued at more than \$2.5 million. Ninety percent of these citizens announced their intentions of gardening next year. Participants were also taught food preparation and nutrition principles and how to preserve food by canning, freezing, and drying for use in periods when fresh vegetables are not available.

Additional benefits of the urban gardening program included community beautification, increased sense of community cooperation, self and civic pride, and reduction of juvenile delinquency. As one program director said of the project, "We didn't just grow vegetables, we actually grew hope."

Expanded Food and Nutrition Education Program

Extension's Expanded Food and Nutrition Education Program (EFNEP) employed 5,673 program aides, trained and supervised by home economists, to reach urban and rural families in about half of the U.S. counties. Over 386,000 low-income families were enrolled in the program during the last 15 months, and 60 percent were from minority groups.

The effectiveness of the program to improve the variety of foods consumed has been appraised. After being in the program for 24 months, the proportion of homemakers providing and serving from each of the four major food groups is about 50 percent higher than the proportion providing such diets at program entry.

The proportion of homemakers providing two servings of milk and meat, and four servings of fruit/vegetables and bread/cereals, is four times higher than the proportion providing such diets upon program entry.

The Family Resource Management Program

Extension's family resource management program provides education in areas of family economics and management and consumer education. Programs are designed to increase knowledge and skills of individuals and families and to help them maintain economic stability and security, effectively manage resources, and become proficient consumers of goods and services for personal and household use.

There has been a dynamic increase in programs related to family financial management (particularly spending, borrowing, and saving) since 1973. Over 80 percent of the States have reported increasing program to help people define realistic financial goals, reallocate income use, determine debt limits, shop comparatively for credit, keep family records, increase savings, and deal with other areas of family management.

Health Programs in States

Health promotion through Extension education for families and individuals focuses on individual awareness and skills in recognizing signs and symptoms of disease and seeking timely treatment. In addition, environmental factors and community facilities which may be modified, controlled, or extended offer other areas of concern in health promotion. These programs are being conducted in all the States and Puerto Rico. The following are typical achievements.

In South Dakota, 1,000 volunteers spent 3 days each over a period of 3 years assisting the mobile breast screening program. Fifty thousand women were screened at 30 locations and 18 percent were recommended for mammography.

In Florida, 30 homemakers presented to the county commissioners the problem of the lack of a medical clinic. They investigated grant opportunities and as a result, their county now has a clinic with emergency and X-ray facilities. The clinic will be self-supporting in 3 years.

In Michigan, a statewide health screening program showed the following results: 1,988 persons visited blood pressure clinics, 900 had glaucoma checkups, 1,822 learned the technique of breast self-examinations, 1,677 took part in drug use and abuse programs, and 300 took first aid courses.

4-H Youth Development

The need for a dynamic, relevant 4-H program is greater today than ever before. All States are implementing 4-H Youth Development programs which: (1) provide educational experiences for youth directed to their individual self-development and as citizens; (2) provide meaningful and practical ways for youth to become engaged in and contribute to many of the important goals of the families and communities of which they are a part; (3) contribute to national goals and the missions of USDA; and (4) enlist in work with youth, their families, and communities. About 5.4 million youths take part in 4-H educational and action programs designed both to meet current youth needs and to provide sound bases for their mature years.

Extension Activities in 1890 Colleges

Sixteen border and Southern States are using funds appropriated specifically for 1890 colleges and Tuskegee Institute to support Extension projects designed to develop and improve informed decisionmaking skills. State Extension Services are applying this support to increase services to all clientele, especially those with limited income.

In Maryland, for example, the 1890 Extension program is providing educational assistance to new or previously unreached audiences and is applying particular emphasis to disadvantaged individuals, families, and communities. Since disadvantaged youth are hard to interest in formal 4-H clubs, the 1890 agents work through special interest groups and special projects that youth can afford.

ENVIRONMENTAL QUALITY AND NATURAL RESOURCES

Integrated Pest Management

Integrated pest management is an ecological approach to the control of harmful pests. The goal is to provide a stable and economically sound method for protecting crops. Extension's integrated pest management projects have grown from a handful of programs in 1972 to projects in all but three States in 1978. They have shown that pesticide use can be cut by 30 to 70 percent.

For example, Louisiana cotton growers in 1975 made an average of 11 applications of insecticides to cotton; during 1978 the average number dropped to 8. One of the reasons this was possible was that cotton growers, acting on extension advice, reduced the rate of nitrogen fertilizer on cotton. Thus, cotton was not as lush and green in early September when one of the cotton pests is more active than at a later date.

Dollar savings from integrated pest management are high enough to justify using the program wherever possible. In West Virginia, alfalfa producers in Jefferson county saved \$8 per acre just by eliminating one scheduled spraying. In Maryland, one group of soybean growers using integrated pest management saved \$7 an acre more than another group not using the program. Similar examples could be cited from other States. The ecological advantage in using less chemicals is, of course, a step to improved environmental quality.

Extension also conducted a certification training program for those persons who apply restricted-use pesticides. This group included about 2 million farmers and 100,000 commercial applicators. As of June 30, 1978, extension had trained an estimated 88 percent of the commercial applicators and 79 percent of the private applicators in meeting certification requirements for applying restricted-use pesticides. Pesticide applicator training is an ongoing program, because applicators have to be recertified periodically and new applicators will have to be certified.

Energy

The major objectives in energy management and conservation in extension programs are (1) to help people understand and use sound techniques for managing and conserving energy on the farm and in the home, and (2) to make State and local officials more aware of energy policy issues that will help communities become more energy efficient without harming the environment.

Much emphasis has been put on ways to reduce use of energy in field operations. Extension programs have resulted in an estimated use reduction of 154 million gallons of gasoline and 60 million gallons of diesel fuel per year -- a savings of approximately \$95 million.

About 13 percent of the total energy used in agricultural production is used for irrigation. Extension work in Nebraska and Kansas indicates a potential savings of 30 to 35 percent in irrigation energy by switching to diesel fuel, improved scheduling, and water-saving techniques.

Programs to reduce energy use in the home include structure modification, changes in household equipment and family energy-use habits, and use of improved insulation materials and methods. Home owners using Extension information have been able to save up to 20 percent of the energy used in the home.

Minimum tillage in agriculture has also contributed to a reduction in energy use. This program -- originally designed to save soil and water -- has markedly reduced fuel consumption because there are fewer tilling

operations. Acreage under minimum tillage increased from 3.8 million acres in 1963 to 39 million acres in 1976. Fuel savings from the shift to minimum tillage are estimated at 47 million gallons of gasoline and 15 million gallons of diesel fuel per year -- or savings of about \$32 million. It is important to note, however, that since minimum tillage requires additional pesticide use, part of the fuel saving is offset. On the other hand, only about 37 percent of the potential usage of minimum tillage has been realized out of a potential two-thirds of the total tilled acreage in the United States.

Weather

SEA-Extension has initiated the development of a National Agricultural Weather Network (NAWN) in cooperation with the National Weather Service to help farmers minimize the impacts of adverse weather and to improve the control of pests.

As part of this effort, an experimental weather/market information program was initiated in FY 1978. A "Green Thumb" box is used by the farmer to get local weather forecasts, market information and other data. The "box" is attached to the farmer's TV and telephone. He can then dial a special telephone number 24 hours a day, and be linked to a small computer in the county Extension office. The county computer transmits programmed data to the farmer's TV for viewing at his convenience.

The experiment is being conducted in two Kentucky counties through a cooperative agreement between SEA-Extension, and the Kentucky Extension Service in cooperation with the National Weather Service. There are four basic elements: gathering weather data from volunteer observers in rural areas, preparing specialized weather and agricultural information, disseminating the information directly to farmers, and a comprehensive educational program to teach farmers how to realize maximum benefits from the information.

ACHIEVEMENTS IN HIGHER EDUCATION

Higher education in food and agricultural sciences has provided the main-spring for agricultural development in the United States and in many parts of the world. Through these programs have come the advanced professional degrees for research and education. When the achievements in the food and agricultural sector are attained, whether it be a new strain of wheat or a renewed effort in human nutrition, the major credit belongs to the basic effective program of education in the food and agricultural disciplines.

International Agriculture

Because of better communication throughout the world and increased concern among young people about the well-being of other people, there is an increased interest among students to devote their professional expertise to international food and agriculture development. Consequently, an increasing number of colleges and universities are introducing specific courses designed to prepare young people for a productive career in assisting the developing

world in producing more food and in the processing and distribution of these products. In anticipation of Federal funding, the professional faculty has become more enthusiastic about research and education focused specifically on the problems of the developing world.

Student-Degree Ratio

The ratio of students enrolled to number of degrees granted continues to be better in food and agricultural programs than for higher education in general. At the undergraduate level, the ratio for 1978 was to 1.

Diminishing Sex Stereotyping

Both male and female students seem to be following their interests regardless of perceived "male" or "female" curricula. In the 1976-77 academic year, 6.5 percent of master of science degrees and 22.2 percent of doctoral degrees in home economics were awarded to males. In the agricultural sciences, females made up 30 percent of the student enrollment. In veterinary medicine, they accounted for about 32 percent.

With this change in student body composition, there may be, in the very near future, an increased number of females in agricultural research and extension and males in roles such as home agents and home economics teachers.

Specialization and Other Trends

Student selection of curricula is generally in accord with administrative organization; that is, agronomy, animal science, horticulture, agricultural economics, and other traditional disciplines. However, there is an increasing number of interdisciplinary curricula, such as integrated pest management, animal bioscience, pathobiology, and environmental studies. Joint degree programs are being developed at several institutions. There is widespread use of communication technology which includes computers and audiovisual systems. Nontraditional programs through which adults may continue their formal education are being developed.

Curricula

Curriculum assessment, modification, and development continue to be high priority issues. Curriculum additions include such subjects as consumer economics, public policy, communications, and food and nutrition. The veterinary medicine curricula have been changed considerably and now include Black studies and postdoctoral specialization.

Grants

Many grants in the agricultural sciences and home economics are provided by industry and private foundations. The grants support better teaching, faculty development, curriculum innovation, career development, and student recruitment.

Attracting Minorities

There is a strong demand for minority professionals trained in food and agriculture. Even with the vigorous and continuing effort to recruit minorities, there is much room for improvement in attracting minority groups to agricultural studies. In the fall of 1978, minority enrollment was only 2 percent of the total; in veterinary medicine it was only 4 percent.

ACHIEVEMENTS IN DISSEMINATING TECHNICAL INFORMATION

Effective communication between persons or groups is essential to better human understanding and a high degree of probability that favorable action will result. Federal and State agricultural sectors are becoming increasingly aware of the validity of this principle. Hence, the dissemination of technical information in 1978 was marked with a number of significant achievements.

Consumer Periodical

Three issues of the National Food Review were published during FY 1978. This new consumer publication summarizes the food supply, price, and consumption situation and outlook. It also reports developments in marketing, consumer research, consumer legislation, and USDA actions of interest to those concerned with consumer problems. National Food Review is a major outlet for research news on consumer food issues.

Farmer Newsletters

A series of farmer newsletters, as authorized by the Congress to aid farmers make production and marketing plans, got underway in FY 1978. Six separate titles were launched--wheat, food, oilseeds, livestock, cotton, and general. Twenty-five issues were mailed free to more than 100,000 farmers by the end of the year.

Pesticide Supply and Demand

Since 1974, USDA has published a report titled Evaluation of Pesticide Supplies and Demand. It was launched at that time because of an acute need for outlook information. In 1978 this report was expanded to include an analysis of how policy actions affect pesticide availability and pest control. The report now provides the only comprehensive evaluation of pesticide production, capacity, inventories, and distribution problems available anywhere.

Energy and Environment Information

USDA's Technical Information Services has signed a cooperative agreement with the Denver public library under which the library's Regional Energy-Environment Center will extend its services to farmers and rural communities in 10 Rocky Mountain and Plains States. The Center hired a special librarian

to work closely with agricultural groups and others interested in energy and environmental information.

Science Information Network

The 1977 Farm Bill sanctioned the concept of the Agricultural Sciences Information Network (ASIN). One of the network's chief goals is to make sure that agricultural scientists have access to all the food and agricultural literature and information they need. Even though ASIN has been operation for several years, Congressional approval of the concept will encourage better cooperation among participating libraries.

The efficiency of ASIN's document delivery system has increased markedly. In 1978 the system delivered 90 percent of the documents researchers requested at Beltsville, Maryland; in 1977 the delivery record was only 50 percent.

Handbooks for Forest Managers

Forest managers now have a number of new handbooks that provide the latest and best information on production and management of eight tree species common to north central forests. All the handbooks contain recommendations that can help forest managers provide the right silvicultural treatments for particular stands of trees. The handbooks also suggest ways of modifying management practices to enhance recreation, wildlife, water, and forest values.

Food and Nutrition Resources

USDA's Food and Nutrition and Education Resources Center reached an additional audience of 5,200 through 20 new promotion programs. Because the Center expects to serve a wider audience in 1979, it mailed out catalogs to the following groups:

- Directors of home economics at the Federal and State levels
- Extension nutrition specialists at the State levels
- Extension management information systems people at the State level
- "Women, Infants, and Children" (WIC) program specialists at the Federal and State levels
- State departments of education

Mass Media Information for Consumers

The Cooperative Extension Service reaches millions of consumers with research-based information from USDA and State land-grant universities through direct teaching methods, publications, and mass media. The following are some examples:

TV Spots -- About half of the States are now using public service spots on commercial TV. Georgia reports that its 30-second spots -- often appearing on prime time -- reach more than half the State's population.

Campaign Approach -- Some States combine mass media techniques in a concentrated effort to get out more information with greater impact and cost savings. Mississippi's "Pocket Watch" campaign, a typical example, emphasizes a different subject area each year by using newsletters, radio, TV, and the press. Consumer information reaches a potential audience of 3 million.

Radio Spots -- New York's recent campaign with energy conservation radio spots had more than 5,000 airings in the first month. At the end of the campaign, 90 different radio stations had used the spots 18,000 times.

Press Day -- Texas Extension staff holds an annual press day for members of the press and other mass media people. At last year's event, the staff scheduled more than 275 interviews with TV, radio, newspaper, and magazine representatives.

Dial Access Phone Messages -- People in 14 Wisconsin counties can now get answers to consumer questions by dialing a number that gives them access to various recorded messages. About 68 percent of the callers say they got the information they wanted. New audiences are being reached.

STATUS OF ONGOING RESEARCH AND EXTENSION PROJECTS

Under the Food and Agriculture Act of 1977, one of the responsibilities of the Joint Council on Food and Agricultural Sciences is to appraise the States of research and extension projects. These appraisals were made under the same three objectives used in reporting achievements: food and fiber productivity, human health and welfare, and environmental quality and natural resources.

In this first report, the appraisals primarily describe the ongoing effort and redirections that have occurred. In later reports, more attention will be focused on results of current program evaluation.

RESEARCH

The data available included research conducted and supported by 3 agencies of the U.S. Department of Agriculture, 56 State agricultural experiment stations, 16 forestry schools, in addition to those included as part of the State agricultural experiment stations, and 17 other cooperating institutions (tables 1 and 2).

Figure 1 and table 1 show that 65 percent of the scientist years in FY 1977 was devoted to research on food and fiber productivity. Nearly two-thirds of this research was performed at State and other cooperating universities.

A comparison of funds expended for research on food and fiber productivity in FY 1970 and FY 1977 (figure 2 and tables 1 and 2) shows quite a different picture than that for scientists. Funds increased by more than 75 percent from both Federal and non-Federal sources. These increases were only slightly more than enough to meet the rising costs required for scientists.

The tables show that 10 percent of the total scientist years was devoted to research on human health and welfare in FY 1977. In FY 1970 this figure was 8 percent. Financial support for FY 1977 was 136 percent greater than for FY 1970. Both State and Federal support for this area of research increased markedly.

Research on environmental quality and natural resources constituted 25 percent of the overall research effort in FY 1977. Between FY 1970 and FY 1977, scientist years increased 22 percent and funding 135 percent.

EXTENSION

Extension programs are carried out by 3,150 county governments in all the States, including the District of Columbia and the territories of Puerto Rico, Virgin Islands, and Guam. The total professional staff includes 16,667 persons. In addition, there are many paraprofessionals and volunteer leaders.

State and county financial support was \$370.6 million in 1978 or 58 percent of the total (table 3). The remaining 42 percent, or \$257.5 million, was provided by USDA.

Table 4 shows how the extension effort was distributed among the three major objectives of the food and agricultural sciences: food and fiber productivity, 38 percent; human health and welfare, 58 percent; and environmental quality and natural resources, 4 percent. As contrasted with research, extension activities in human health and welfare dominate the total effort.

REDIRECTIONS

Redirection of research activity occurs on a continuing basis and at all levels in USDA and cooperating institutions. Researchers revise, update, or shift the emphasis of their work, depending on their own findings or the results of others. New problems or emergencies cause shifts that may be short or long term according to the nature of the problem and how quickly solutions are found. When the energy crisis hit a few years ago, several scientists working on energy-intensive practices immediately initiated new experiments such as no-till practices. Redirection also occurs when diseases and pests of plants and animals worsen. Professional meetings, workshops, project reviews, and consultations between line managers and staff personnel play a role in these kinds of redirections. But the major force is the desire to be responsive to societal needs and to strive for scientific excellence.

At a higher administrative level, people and funds may be redirected from completed projects to new or higher priority work. Frequently, work may be

simply discontinued in favor of more urgent problems. People and funds may be collected from several projects to tackle a new problem.

The main constraint on staff redirection is technical training and experience. At least a decade of training is needed to become a top scientist or extension specialist, and often retraining is not a viable option. Related to this is the long-time needed to create a fully effective research team. Studies show that these teams often do not reach their peak performance for 3 to 7 years. This is a particular constraint for redirections that require interdisciplinary teams, such as agronomists, engineers, and economists working on a problem that demands skills of several disciplines.

Facilities and equipment are becoming increasingly more expensive and specialized. Much research and extension must be tied to the area where it is to be used because of unique combinations of soils, climates, and cultural practices.

Despite these constraints, many redirections have been made. For example, table 5 shows that in the 7-year period 1970-77, inhouse research of the Science and Education Administration increased some broad program areas as much as 166 percent and decreased others as much as 66 percent. Changes made by SEA cooperators during approximately the same period were equally significant (table 6), especially in aquatic and environmental research.

Economic research and analysis at the Federal level has also changed substantially in character over the last 5 to 10 years. To a large degree, the emphasis has followed the growing public concern over environmental issues, energy, the quality of life of rural people, problems related to pesticides, and concerns related to the structure of agriculture. But even so, the research and statistical programs tend to be predominantly agriculture and commodity oriented. At the same time, the research form has drifted away from problems related to the management of individual farms and firms to research on the broader issues of public programs and policies.

Table 7 shows the nature and extent of Extension redirections during the 1970's. The greatest percentage increase occurred in rural community development activities that relate to economic growth. The greatest decrease was in marketing skills in rural community development. Other important increases of effort were in crop and livestock production, natural resources and environment, and family living.

CURRENT ACTIVITIES IN PLANNING AND COORDINATION

Over the years, the land-grant universities and the U.S. Department of Agriculture have had various kinds of systems and activities for planning and coordinating research and extension at both the regional and national levels.

The universities have regional association of research and extension directors who meet regularly to exchange information, develop plans for coordination, and set up cooperative plans. Workshop groups and technical committees consider suitable projects for regional research and extension projects.

At the national level, land-grant universities coordinate research, teaching, and extension primarily through standing committees of the National Association of Land-Grant Colleges and Universities. Three of the chief committees are the Extension Committee on Organization and Policy (ECOP), Resident Instruction Committee on Organization and Policy (RICOP), and the Experiment Station Committee on Organization and Policy (ESCOP).

Within the USDA agencies, there are special planning and coordination staffs in addition to the supervisory activities of the administrators. There is also the statutory Committee of Nine made up of State experiment station directors who coordinate the regional research programs and approve all regional projects funded by the USDA.

Prior to the expiration of its charter in 1977, the Agricultural Research Policy Advisory Committee (ARPAC) -- a joint USDA-University committee -- carried out the formal planning and coordination of research among universities, industry, and the USDA.

In February 1978, planning and coordination in agricultural matters took on a new dimension with the establishment of the Joint Council on Food and Agricultural Sciences in accordance with P.L. 95-113. The primary responsibility of the Joint Council is to foster coordination of the agricultural research, extension, and teaching activities of the Federal Government, the States, colleges and universities, and other public and private institutions and persons involved in the food and agricultural sciences. Council membership includes representatives from USDA agencies with research, extension, and teaching responsibilities, from land-grant universities, from State agricultural experiment stations, from the Office of Science and Technology Policy, and from other institutions. Producers, and the public also are represented.

The Joint Council had three meetings during 1978. Members agreed to complete the activities initiated by the following committees of the Agricultural Research Policy Advisory Committee: Recombinant DNA research committee, Current Research Information System (CRIS) committee, steering committee for national program of forest resources research, committee on coordinating marketing research, committee on technology assessment, and the joint Federal-State task force on crop losses.

In addition, the Joint Council has undertaken joint sponsorship with USDA of the following studies requested by the Congress under P.L. 95-113: weather and water allocation study, organic waste study, evaluation of extension, research facilities, and the 5-year plan for food and agricultural sciences.

The Joint Council established six standing committees: Executive, budget, CRIS, committee to develop guidelines for funding 1890 institutions and Tuskegee Institute, recombinant DNA committee, and priorities and strategies committee. In addition, the Council has continued the national and regional research planning activities through an Interim National Research Planning Committee/Regional Planning Committee and is developing a revised planning structure that will encompass teaching and extension, as well as research. Decisions on the structure for the planning and coordination efforts of the Joint Council will be determined at the January 1979 meeting of the Council.

The Joint Council has recommended a policy on recombinant DNA research to the USDA and cooperating institutions. Among other things, this policy includes a recommendation to establish institutional biosafety committees to govern scientists working on recombinant DNA.

The Joint Council accepted reports of nationwide efforts in research planning and coordination in two areas of agricultural sciences -- forestry and home economics. These studies were in progress when the Joint Council was formed. The forestry study is the plan for research for the next 10 years, and was developed by the Forest Service, Cooperative Research/SEA, the cooperating universities, and industry. The home economics report entitled, Home Economics Research Assessment Planning Projections (HERAPP), is the result of cooperative planning by research, extension, and teaching personnel in the States, the Federal Government, and industry.

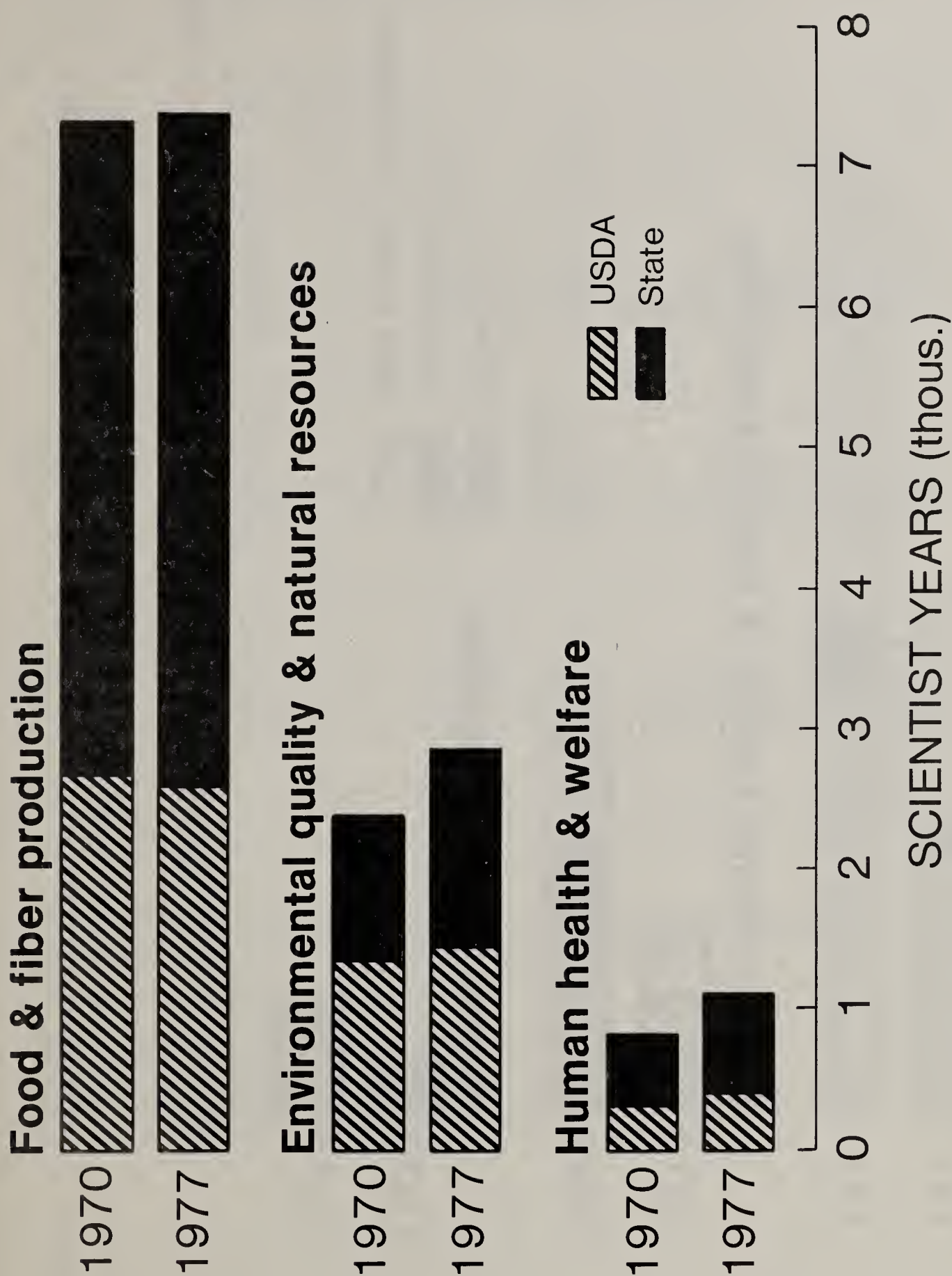


Figure 1 -- Scientist years expended for agricultural research by Federal and State Agencies for Fiscal Years 1970 and 1977.

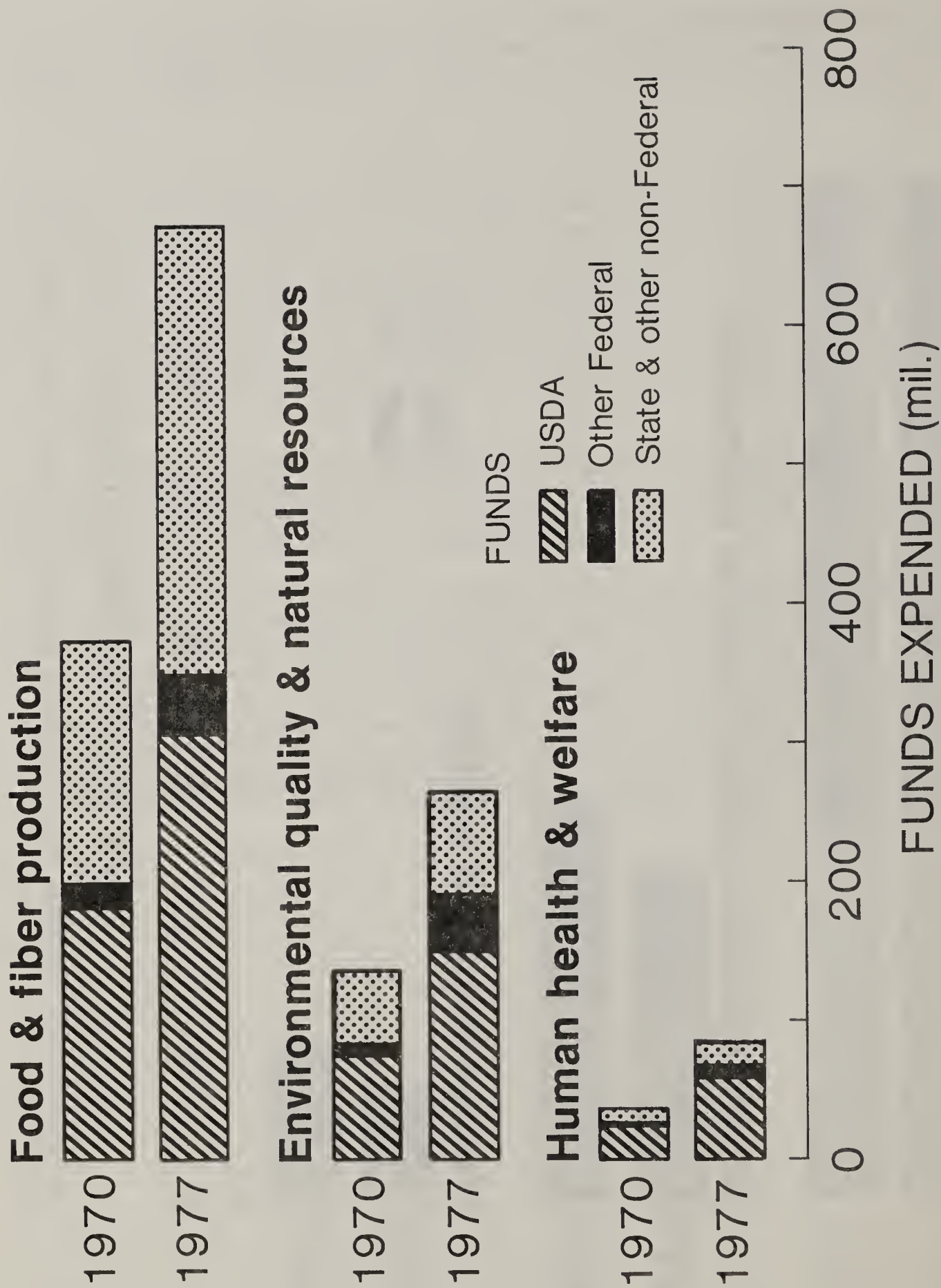


Figure 2 -- Funds expended for agricultural research by Federal and State agencies and other cooperating institutions for Fiscal Years 1970 and 1977.

Table 1 -- Funds and scientist years expended for agricultural research
by program and research organization, FY 1977 ^{1/}

Program	Research ^{2/} organization	Funds				Scientist years
		USDA	Other Federal	Non- Federal	Total	
Food and fiber productivity		-----Thousand dollars-----				
	ESCS	21,907	71	15	21,993	365.2
	FS	0	0	0	0	0.0
	SEA	203,457	6,660	578	210,695	2,181.8
	Subtotal USDA	225,364	6,731	593	232,688	2,547.0
	State	78,413	37,331	333,391	449,136	4,810.3
	Total	303,777	44,062	333,984	681,823	7,357.3
Human health and welfare	ESCS	3,972	198	0	4,170	64.4
	FS	0	0	0	0	0.0
	SEA	28,765	3,827	40	32,632	355.4
	Subtotal USDA	32,737	4,025	40	36,802	419.8
	State	18,010	7,376	27,053	52,439	692.1
	Total	50,747	11,400	27,092	89,240	1,111.9
	Environmental quality and natural resources	ESCS	2,305	353	0	2,658
FS		86,332	6,081	0	92,413	951.5
SEA		39,829	5,111	262	45,203	459.8
Subtotal USDA		128,466	11,545	262	140,274	1,459.9
State		22,429	23,485	74,365	120,280	1,416.2
Total		150,895	35,030	74,628	260,554	2,876.2
Total research			505,420	90,492	435,704	1,031,618

^{1/} This table reflects data provided to the Current Research Information System (CRIS) by the USDA research agencies, 56 State agricultural experiment stations (SAES), 16 forestry schools, and 17 other cooperating institutions.

^{2/} Research organization abbreviations:

ESCS -- Economics, Statistics, and Cooperatives Service

FS -- Forest Service

SEA -- Science and Education Administration

State -- State agricultural experiment stations, forestry schools, and other cooperating institutions

Table 2 -- Funds and scientist years expended for agricultural research
by program area and research organization, FY 1970 ^{1/}

Program	Research ^{2/} organization	Funds				Scientist years
		USDA	Other Federal	Non- Federal	Total	
-----Thousand dollars-----						
Food and fiber productivity	ESCS	11,330	0	0	11,330	376.1
	FS	2,138	41	39	2,218	45.9
	SEA	117,381	549	601	118,531	2,242.9
	Subtotal USDA	130,848	590	640	132,079	2,664.9
	State	44,758	23,415	184,950	253,122	4,628.1
	Total	175,605	24,005	185,590	385,201	7,293.0
Human health and welfare	ESCS	1,762	252	0	2,014	69.1
	FS	1,617	22	27	1,666	34.6
	SEA	12,642	337	25	13,004	229.9
	Subtotal USDA	16,022	610	51	16,684	333.6
	State	4,738	4,423	11,568	20,729	484.3
	Total	20,760	5,034	11,619	37,413	817.9
Environmental quality and natural resources	ESCS	586	20	9	616	27.9
	FS	40,743	1,224	604	42,573	870.1
	SEA	23,643	1,103	125	24,872	445.9
	Subtotal USDA	64,973	2,348	739	68,060	1,343.8
	State	9,534	7,233	28,972	45,739	1,030.9
	Total	74,507	9,581	29,711	113,800	2,374.7
Total research		270,873	38,621	226,920	536,415	10,485.6

^{1/} This table reflects data provided to the Current Research Information System (CRIS) by the USDA research agencies, 56 State agricultural experiment stations (SAES), 16 forestry schools in addition to those included as part of the State agricultural experiment stations, and 17 other cooperating institutions.

^{2/} Research organization abbreviations:

ESCS -- Economics, Statistics, and Cooperatives Service

FS -- Forest Service

SEA -- Science and Education Administration

State -- State agricultural experiment stations, forestry schools, and other cooperating institutions

Table 3 -- Financial support for Extension work, FY 1970-78

Fund sources	1970	1971	1972	1973	1974	1975	1976	1977	1978
	-----Thousand dollars-----								
State	119,115	129,562	136,090	148,218	161,897	181,848	205,981	220,906	244,812
County	53,485	58,613	63,582	66,387	71,744	79,126	91,805	93,612	111,019
Non-tax	<u>5,369</u>	<u>5,531</u>	<u>6,167</u>	<u>7,382</u>	<u>8,206</u>	<u>8,539</u>	<u>8,839</u>	<u>11,612</u>	<u>14,787</u>
Subtotal	177,969	193,706	205,839	221,987	241,847	269,513	306,625	326,130	370,618
USDA	<u>131,734</u>	<u>160,950</u>	<u>172,279</u>	<u>194,331</u>	<u>204,073</u>	<u>215,513</u>	<u>228,935</u>	<u>241,906</u>	<u>257,562</u>
Total	309,703	354,656	378,118	416,318	445,920	485,026	535,560	568,038	628,180

Table 4 -- State Extension professional staff years expended, FY 1977

Item	Time expended	Percent of program area	Percent of total program
	<u>Staff years</u>	<u>-----Percent-----</u>	
Food and fiber productivity			
Crop production and management	3192.9	49.1	18.5
Livestock production & management	1752.5	27.0	10.2
Farm business and management	992.3	15.3	5.8
Agricultural marketing and supply	561.1	8.6	3.2
Subtotal	6498.8	100.0	37.7
Human health and welfare			
4-H Youth	4900.8	48.6	28.5
Home Economics			
Food & nutrition (other than EFNEP)	738.8	7.3	4.3
Food & nutrition (EFNEP-adult)	610.5	6.1	3.5
Family resource management	606.5	6.0	3.5
Family life education	626.7	6.2	3.7
Housing & home economics	744.8	7.4	4.3
Family health & safety	160.4	1.6	0.9
Textiles & clothing	399.4	4.0	2.3
Subtotal	3887.1	38.6	22.5
Community resource development			
Community org. & leadership dev.	528.8	5.3	3.1
Comprehensive planning	119.7	1.2	0.7
Community services & facilities	145.6	1.4	0.8
Housing	55.4	0.5	0.3
Community health & welfare	67.8	0.7	0.4
Manpower development	72.3	0.7	0.4
Recreation & tourism	84.9	0.8	0.5
Business & industrial development	119.4	1.2	0.7
Taxation & local government	96.5	1.0	0.6
Subtotal	1290.4	12.8	7.5
Subtotal Human health and welfare	10078.3	100.0	58.5
Natural resources and environment			
Natural resources <u>1/</u>	511.2	78.9	3.0
Environmental improvement <u>2/</u>	136.4	21.1	0.8
Subtotal	647.6	100.0	3.8

1/ Closely related to food and fiber productivity programs.

2/ Closely related to community resource development programs.

Table 5 -- Redirection of research effort, Agricultural Research, Science and Education Administration, 1970-77

Commodity	1970 Base	Change: 1970 to 1977	
		<u>Years</u>	<u>Percent</u>
	<u>Scientist years</u>		
Plants (general)	67	+88	+131
Food	50	+83	+166
Beef	161	+26	+ 16
Soybeans	80	+31	+ 39
Swine	53	+23	+ 43
Water	176	-43	- 24
Dairy	157	-31	- 20
Cotton	283	-32	- 11
Other oilseed	59	-39	- 66
Corn	146	-26	- 28

Table 6 -- Redirections of research effort, State agricultural experiment stations, 1890 colleges, and forestry schools, 1970-77

Research program	1970 Base	Change: 1970 to 1977	
	<u>Scientist years</u>	<u>Years</u>	<u>Percent</u>
Environmental quality	260	+215	+ 83
Rural develop & quality family living	291	+ 95	+ 33
Food and nutrition	232	+162	+ 70
Soybeans	178	+116	+ 65
Forest protection	291	+ 57	+ 19
Forest, watersheds, soils	143	+ 48	+ 34
Aquatic food and feedstuffs	26	+ 43	+165
Foreign trade and economics	122	+ 29	+ 24
Dairy	439	- 56	- 13
Farm adjustment, price, income	282	- 65	- 23
Cotton	475	- 68	- 14
Water and watersheds	362	- 54	- 15
Fruit	673	- 26	- 4
Poultry	351	- 52	- 15
Tobacco	148	- 38	- 26
New crops & minor oilseeds	127	- 31	- 24

Table 7 -- Redirections of Extension effort, 1971-77

Extension activity	1971 Base	Change: 1971 to 1977	
	<u>Staff years</u>	<u>Years</u>	<u>Percent</u>
Agricultural crop production and management	1,811	+1,191	+ 65
Agricultural livestock production and management	970	+ 702	+ 72
Improve family living interpersonal relations	294	+ 290	+ 98
Natural resources and environment	263	+ 223	+ 84
Rural community development economic growth	89	+ 190	+213
Improve family living resource utilization	466	+ 94	+ 20
Rural community leadership development	433	+ 65	+ 15
Improve family living human health practices	114	+ 32	+ 28
Rural community development facilities and services	138	+ 5	+ 4
Human apparel	398	- 16	- 4
Agricultural marketing and supply	560	- 31	- 6
Rural community development action and organization	360	- 65	- 18
Rural community development developing marketing skills	144	- 76	- 53
Human housing and home environment	1,160	- 408	- 35
Farm business and management	1,361	- 447	- 33
Human nutrition	2,040	- 756	- 37
4-H Youth development	5,347	- 787	- 15

